# SEASONAL DETECTION OF VISIBLE DUTCH ELM DISEASE SYMPTOMS

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**Abstract.** Most of the lightly diseased American elms (10% or less crown wilt) that were suitable candidates for fungicide injection and/or pruning therapy for Dutch elm disease were discovered in surveys during June and early July. More treatable elms were found in areas where diseased elms were removed promptly (up to 20 work days after discovery) than where removal was delayed until fall and winter, and in areas where the smaller European elm bark beetle is the primary vector of Dutch elm disease rather than where the native elm bark beetle is the primary vector.

Surveying urban elms for Dutch elm disease (DED) is a key step in managing this disease. Appropriate control techniques depend chiefly on how much of the tree is diseased. Elms with more than 10 percent of the crown showing DED symptoms are best removed as quickly as possible. Those with the diseased portion being 10 percent or less could be candidates for fungicide injection and/or pruning. These control techniques have the best rate of success when applied to lightly diseased elms (5).

In this report we summarize the results of DED surveys from several diverse communities to illustrate the proportion of diseased elms that might benefit from these treatments.

## Study Areas and Methods

DED surveys were made in Wisconsin and Michigan. Three Wisconsin communities were included in our first study area. Their populations of elm, *Ulmus americana,* ranged from about 1,500 to 8,000 trees. All communities routinely surveyed their elms for DED monthly during the summer and had cooperated with state and federal agencies in the Wisconsin DED Control Demonstration Program. According to Kostichka (4), in two of the communities (A and B) the native elm bark beetle, *Hylurgopinus rufipes,* is the primary vector of DED. The smaller European elm bark beetle, *Scolytus multistriatus,* is the primary vector in the third community (C).

In all three communities surveys were made on foot. We asked the surveyors to follow their customary survey routine. Elms were inspected for observable DED symptoms such as wilting and yellowing or drying of the foliage, or defoliated branches. When a diseased elm was located, the surveyors recorded the percentage of diseased crown according to the categories shown in Figure 1. Diseased elms were either treated or removed within 20 work days.

The second study area was a 6.6-square-mile section of Detroit, Michigan. There the primary DED vector is the smaller European elm bark beetle. About 7,000 American elms were surveyed by two experienced individuals. One drove a vehicle slowly along the streets while the other paid strict attention to spotting DED symptoms. Only the trees to the right of the observer were inspected, so each street was traversed twice to observe all elms. When an elm with DED symptoms was spotted, the surveyors determined the approximate percentage of diseased crown. The categories illustrated in Figure 1 were not used. Instead, the surveyors classified the extent of crown involvement as 1% to 20%, 21% to 50%,

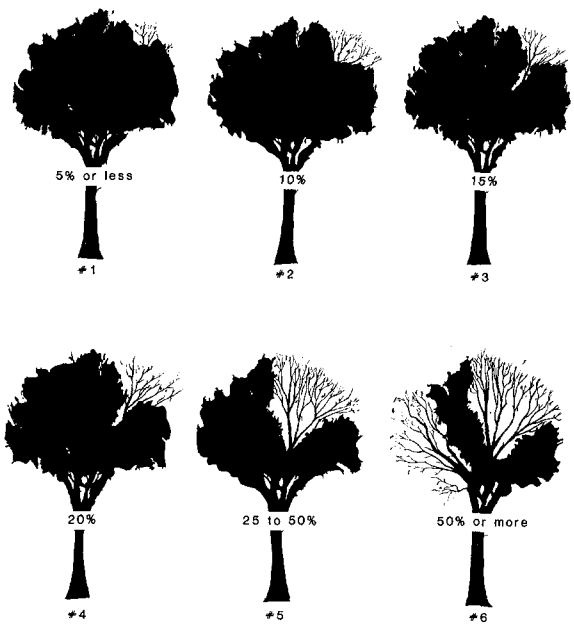


**Figure 1. Categories of the proportion of affected crown of American elms showing visible symptoms of Dutch elm disease.**

or more than 50%. Surveys were made in mid-June and mid-August in part of the area where diseased elms were removed only in fall and winter. Where diseased elms were removed within 20 work days, an additional survey was made in mid-July.

## Survey Results

Wisconsin study areas. Data collected during each month's surveys were tabulated according to the crown category illustrated in Figure 1 (Table 1). The percentage of diseased elms in each category varied according to the community and time of season. Surveyors in community B found fewer lightly diseased elms than those in communities A and C. Results of the June surveys in A and B were similar. But all three communities differed in the proportions of crown involvement of elms showing DED symptoms during July surveys. The August surveys found more lightly diseased elms in community C than in B.

In Table 2 we have combined the data in Table 1 into broad categories corresponding to therapy treatment criteria suggested by Allison and Gregory (1), and Sherald and Gregory (5): elms with 5% or less wilt may be pruned, those with 10% or less wilt may be injected with a fungicide before being pruned, and those with greater than 10% wilt should be removed.

Judged by these criteria, few diseased elms were candidates for pruning; 12% in community A, 10% in community C, and none in community B.

Candidates for fungicide injection followed by pruning were 35% of the diseased elms in community C, 24% in community A, and 2% in community B.

In communities B and C, 50% and 55% of the diseased elms that were discovered showed DED symptoms in June. Peak percentage of diseased elms was delayed until July in community A.

Michigan study area. Lightly diseased elms (1 to 20% of crown showing DED symptoms) were 60% of the total in the section where diseased elms were removed within 20 work days. In the section where diseased tree removal was delayed until fall and winter, 24% were lightly diseased. In both cases, more diseased elms (51% and 46%) were detected in June than were found during

**Table 1. Percentage of diseased American elms categorized by extent of crown involvement as illustrated in Figure 1, Wisconsin communities.**

| | *Crown category* | | | | | |
|---|---|---|---|---|---|---|
| *Month* | *1* | *2* | *3* | *4* | *5* | *6* |
| **Community A** | | | | | | |
| June | 1 | 0 | 2 | 3 | 7 | 26 |
| July | 11 | 12 | 4 | 3 | 13 | 18 |
| **Community B** | | | | | | |
| June | 0 | 2 | 1 | 8 | 16 | 23 |
| July | 0 | 0 | 2 | 8 | 12 | 14 |
| August | 0 | 0 | 0 | 2 | 8 | 4 |
| **Community C** | | | | | | |
| June | 9 | 15 | 4 | 8 | 10 | 9 |
| July | 1 | 4 | 5 | 2 | 4 | 1 |
| August | 0 | 6 | 5 | 8 | 7 | 2 |

**Table 2. Percentage of diseased American elms categorized by percentage of diseased crown, Wisconsin communities.**

| | *Percentage of diseased crown* | | | |
|---|---|---|---|---|
| *Month* | *<5* | *<10* | *>10* | *Total* |
| **Community A** | | | | |
| June | 1 | 1 | 38 | 39 |
| July | 11 | 23 | 38 | 61 |
| **Community B** | | | | |
| June | 0 | 2 | 48 | 50 |
| July | 0 | 0 | 36 | 36 |
| August | 0 | 0 | 14 | 14 |
| **Community C** | | | | |
| June | 9 | 24 | 31 | 55 |
| July | 1 | 5 | 12 | 17 |
| August | 0 | 6 | 22 | 28 |

**Table 3. Percentage of diseased American elms categorized by extent of crown involvment; Detroit, Michigan.**

| | *Percentage of diseased crown* | | | |
|---|---|---|---|---|
| *Month* | *1 to 20* | *21 to 50* | *>50* | *Total* |
| **Disease elms removed only in fall and winter** | | | | |
| June | 11 | 23 | 17 | 51 |
| August | 13 | 22 | 14 | 49 |
| **Diseased elms removed within 20 days** | | | | |
| June | 31 | 7 | 8 | 46 |
| July | 17 | 11 | 9 | 37 |
| August | 12 | 3 | 2 | 17 |

surveys later in the summer.

Bark beetle vectors. In the Wisconsin communities A and B, where the native elm bark beetle is the primary vector of DED, 36% and 23% of the elms had 20% or less of the crown showing wilt symptoms. Where the smaller European elm bark beetle is the primary vector, in Wisconsin community C and in the Michigan study area with prompt removal of diseased elms, 67% and 60% of the diseased elms had 20% or less of the crown showing DED symptoms.

**Discussion and Conclusions**

Deciding which DED treatment is feasible depends on the severity and extent of infection when an elm is discovered to have DED. The effectiveness of techniques now used to manage DED and protect a community's elms depends on doing the right thing at the right time.

Elms properly treated during the early stages of DED infection can be expected to have a high probability of surviving the disease (3). Timing is important for the success of the therapeutic treatments of injecting fungicide into the tree and pruning out infected limbs. For these treatments to be effective, DED symptoms must be observed when only a small area of the crown is involved (10% or less wilt) and before the fungus has progressed into the major branches and trunk of the tree (3).

Survey for diseased elms is the key to finding trees with minimal infections that may be candidates for these treatments. The data from DED surveys in the communities in our study show that more treatable trees can be expected to be found in early summer rather than late in the season. Even though the survey data from Michigan were classified into fewer categories than the Wisconsin data, the trends were similar.

The primary species of bark beetle vector present in a community affected the number of treatable elms found during a DED survey. In communities where the smaller European elm bark beetle is the primary vector, more treatable elms were found than in communities where the native elm bark beetle is the primary vector.

The two survey methods used (surveys made on foot or using a vehicle) were appropriate for the situations in the communities and we made no attempt to draw conclusions about which was best. Each method has its advantages and can be used effectively.

The sanitation program used by a community affected the number of treatable elms that were found during each survey. More were found where diseased elms were removed quickly than where removal was delayed until fall and winter.

Our results emphasize that surveying for diseased elms is well worth the time. Each one detected when 10% or less of the crown shows DED symptoms is a candidate for tree-saving techniques. But the time and money spent on survey programs, including the hiring and training qualified surveyors, is well spent only if DED managers are prepared to apply appropriate treatments.

The expense of removing diseased elms makes it financially attractive to increase survey efforts to locate those that could be treated (2). Detecting and treating lightly diseased elms would reduce the number that would have to be removed immediately. Early summer is the best time to locate candidates for therapy treatments.

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